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## MB9B160L Series

# 32-Bit ARM<sup>®</sup> Cortex<sup>®</sup> - M4F FM4 Microcontroller

Devices in the MB9B160L Series are highly integrated 32-bit microcontrollers with high performance and competitive cost.

This series is based on the ARM<sup>®</sup> Cortex<sup>®</sup>-M4F Processor with on-chip Flash memory and SRAM. The series has peripheral functions such as Motor Control Timers, ADCs and Communication Interfaces (UART, CSIO, I<sup>2</sup>C, LIN).

## Features

### 32-bit ARM<sup>®</sup> Cortex<sup>®</sup>-M4F Core

- Processor version: r0p1
- Up to 160 MHz Frequency Operation
- FPU built-in
- Support DSP instruction
- Memory Protection Unit (MPU): improves the reliability of an embedded system
- Integrated Nested Vectored Interrupt Controller (NVIC): 1 NMI (non-maskable interrupt) and 128 peripheral interrupts and 16 priority levels
- 24-bit System timer (Sys Tick): System timer for OS task management

### On-chip Memories

#### [Flash memory]

These series are based on two independent on-chip Flash memories.

- MainFlash memory
  - Up to 512 Kbytes
  - Built-in Flash Accelerator System with 16 Kbytes trace buffer memory
  - The read access to Flash memory can be achieved without wait-cycle up to operation frequency of 72 MHz. Even at the operation frequency more than 72 MHz, an equivalent access to Flash memory can be obtained by Flash Accelerator System.
  - Security function for code protection
- WorkFlash memory
  - 32 Kbytes
  - Read cycle:
    - 6wait-cycle: the operation frequency more than 120 MHz, and up to 160 MHz
    - 4wait-cycle: the operation frequency more than 72 MHz, and up to 120 MHz
    - 2wait-cycle: the operation frequency more than 40 MHz, and up to 72 MHz
    - 0wait-cycle: the operation frequency up to 40 MHz
  - Security function is shared with code protection

#### [SRAM]

This is composed of three independent SRAMs (SRAM0, SRAM1, and SRAM2). SRAM0 is connected to I-code bus and D-code bus of Cortex-M4F core. SRAM1 and SRAM2 are connected to System bus of Cortex-M4F core.

- SRAM0: Up to 32 Kbytes
- SRAM1: Up to 16 Kbytes
- SRAM2: Up to 16 Kbytes

#### Multi-function Serial Interface (Max 6 channels)

- 64 bytes with FIFO (the FIFO step numbers are variable depending on the settings of the communication mode or bit length.)
- Operation mode is selectable from the followings for each channel.
  - UART
  - CSIO
  - LIN
  - I<sup>2</sup>C
- UART
  - Full-duplex double buffer
  - Selection with or without parity supported
  - Built-in dedicated baud rate generator
  - External clock available as a serial clock
  - Hardware Flow control : Automatically control the transmission by CTS/RTS (only ch.4)
  - Various error detect functions available (parity errors, framing errors, and overrun errors)
- CSIO
  - Full-duplex double buffer
  - Built-in dedicated baud rate generator
  - Overrun error detect function available
  - Serial chip select function (ch.6 only)
  - Supports high-speed SPI (ch.0 and ch.6 only)
  - Data length 5 to 16-bit
- LIN
  - LIN protocol Rev.2.1 supported
  - Full-duplex double buffer
  - Master/Slave mode supported
  - LIN break field generation (can change to 13 to 16-bit length)
  - LIN break delimiter generation (can change to 1 to 4-bit length)



- Various error detect functions available (parity errors, framing errors, and overrun errors)
- I<sup>2</sup>C
  - Standard mode (Max 100 kbps) / High-speed mode (Max 400 kbps) supported
  - Fast mode Plus (Fm+) (Max 1000 kbps, only for ch.3=ch.A and ch.4=ch.B) supported

### DMA Controller (8 channels)

DMA Controller has an independent bus for CPU, so CPU and DMA Controller can process simultaneously.

- 8 independently configured and operated channels
- Transfer can be started by software or request from the built-in peripherals
- Transfer address area: 32-bit (4 Gbytes)
- Transfer mode: Block transfer/Burst transfer/Demand transfer
- Transfer data type: bytes/half-word/word
- Transfer block count: 1 to 16
- Number of transfers: 1 to 65536

### DSTC (Descriptor System data Transfer Controller) (128 channels)

The DSTC can transfer data at high-speed without going via the CPU. The DSTC adopts the Descriptor system and, following the specified contents of the Descriptor which has already been constructed on the memory, can access directly the memory /peripheral device and performs the data transfer operation.

It supports the software activation, the hardware activation and the chain activation functions.

### A/D Converter (Max 15 channels) [12-bit A/D Converter]

- Successive Approximation type
- Built-in 2 units
- Conversion time: 0.5 μs @ 5 V
- Priority conversion available (priority at 2levels)
- Scanning conversion mode
- Built-in FIFO for conversion data storage (for SCAN conversion: 16steps, for Priority conversion: 4steps)

### DA Converter (Max 2 channels)

- R-2R type
- 12-bit resolution

### Base Timer (Max 8 channels)

Operation mode is selectable from the followings for each channel.

- 16-bit PWM timer
- 16-bit PPG timer

- 16-/32-bit reload timer
- 16-/32-bit PWC timer

### General Purpose I/O Port

This series can use its pins as general purpose I/O ports when they are not used for external bus or peripherals. Moreover, the port relocate function is built in. It can set which I/O port the peripheral function can be allocated.

- Capable of pull-up control per pin
- Capable of reading pin level directly
- Built-in the port relocate function
- Up to 48 high-speed general-purpose I/O ports @ 64 pin Package
- Some pin is 5 V tolerant I/O.  
See 4. Pin Description and 5. I/O Circuit Type for the corresponding pins.

### Multi-function Timer (Max 2 units)

The Multi-function timer is composed of the following blocks.

Minimum resolution: 6.25 ns

- 16-bit free-run timer × 3 ch./unit
- Input capture × 4 ch./unit
- Output compare × 6 ch./unit
- A/D activation compare × 6 ch./unit
- Waveform generator × 3 ch./unit
- 16-bit PPG timer × 3 ch./unit

The following function can be used to achieve the motor control.

- PWM signal output function
- DC chopper waveform output function
- Dead time function
- Input capture function
- A/D convertor activate function
- DTIF (Motor emergency stop) interrupt function

### Real-time clock (RTC)

The Real-time clock can count Year/Month/Day/Hour/Minute/Second/A day of the week from 01 to 99.

- Interrupt function with specifying date and time (Year/Month/Day/Hour/Minute/Second/A day of the week.) is available. This function is also available by specifying only Year, Month, Day, Hour or Minute.
- Timer interrupt function after set time or each set time.
- Capable of rewriting the time with continuing the time count.
- Leap year automatic count is available.

## Quadrature Position/Revolution Counter (QPRC) (1 channel)

The Quadrature Position/Revolution Counter (QPRC) is used to measure the position of the position encoder. Moreover, it is possible to use up/down counter.

- The detection edge of the three external event input pins AIN, BIN, and ZIN is configurable.
- 16-bit position counter
- 16-bit revolution counter
- Two 16-bit compare registers

## Dual Timer (32-/16-bit Down Counter)

The Dual Timer consists of two programmable 32-/16-bit down counters.

Operation mode is selectable from the followings for each channel.

- Free-running
- Periodic (=Reload)
- One-shot

## Watch Counter

The Watch counter is used for wake up from the low-power consumption mode. It is possible to select the main clock, sub clock, built-in high-speed CR clock or built-in low-speed CR clock as the clock source.

Interval timer: up to 64 s (Max) @ Sub Clock: 32.768 kHz

## External Interrupt Controller Unit

- External interrupt input pin: Max 16 pins
- Include one non-maskable interrupt (NMI)

## Watchdog Timer (2 channels)

A watchdog timer can generate interrupts or a reset when a time-out value is reached.

This series consists of two different watchdogs, a "Hardware" watchdog and a "Software" watchdog.

"Hardware" watchdog timer is clocked by low-speed internal CR oscillator. Therefore, "Hardware" watchdog is active in any power saving mode except STOP.

## CRC (Cyclic Redundancy Check) Accelerator

The CRC accelerator helps a verify data transmission or storage integrity.

CCITT CRC16 and IEEE-802.3 CRC32 are supported.

- CCITT CRC16 Generator Polynomial: 0x1021
- IEEE-802.3 CRC32 Generator Polynomial: 0x04C11DB7

## Clock and Reset

### [Clocks]

Five clock sources (2 external oscillators, 2 internal CR oscillator, and Main PLL) that are dynamically selectable.

- Main clock: 4 MHz to 48 MHz
- Sub Clock: 32.768 kHz
- High-speed internal CR Clock: 4 MHz
- Low-speed internal CR Clock: 100 kHz
- Main PLL Clock

### [Resets]

- Reset requests from INITX pin
- Power on reset
- Software reset
- Watchdog timers reset
- Low voltage detector reset
- Clock supervisor reset

## Clock Super Visor (CSV)

Clocks generated by internal CR oscillators are used to supervise abnormality of the external clocks.

- External OSC clock failure (clock stop) is detected, reset is asserted.
- External OSC frequency anomaly is detected, interrupt or reset is asserted.

## Low-Voltage Detector (LVD)

This Series include 2-stage monitoring of voltage on the VCC pins. When the voltage falls below the voltage has been set, Low-Voltage Detector generates an interrupt or reset.

- LVD1: error reporting via interrupt
- LVD2: auto-reset operation

## Low-power Consumption Mode

Six low-power consumption modes are supported.

- SLEEP
- TIMER
- RTC
- STOP
- Deep standby RTC (selectable from with/without RAM retention)
- Deep standby stop (selectable from with/without RAM retention)

### **VBAT**

The consumption power during the RTC operation can be reduced by supplying the power supply independent from the RTC (calendar circuit)/32 kHz oscillation circuit. The following circuits can also be used.

- RTC
- 32 kHz oscillation circuit
- Power-on circuit
- Back up register: 32 bytes
- Port circuit

### **Debug**

- Serial Wire JTAG Debug Port (SWJ-DP)

### **Unique ID**

Unique value of the device (41-bit) is set.

### **Power Supply**

Two Power Supplies

- Wide range voltage:       VCC       = 2.7 V to 5.5 V
- Power supply for VBAT:    VBAT       = 2.7 V to 5.5 V

## Contents

<b>Features</b> .....	<b>1</b>
<b>1. Product Lineup</b> .....	<b>7</b>
<b>2. Packages</b> .....	<b>8</b>
<b>3. Pin Assignment</b> .....	<b>9</b>
<b>4. Pin Description</b> .....	<b>13</b>
4.1 List of Pin Numbers .....	13
4.2 List of Pin Functions .....	19
<b>5. I/O Circuit Type</b> .....	<b>28</b>
<b>6. Handling Precautions</b> .....	<b>35</b>
6.1 Precautions for Product Design .....	35
6.2 Precautions for Package Mounting.....	36
6.3 Precautions for Use Environment.....	37
<b>7. Handling Devices</b> .....	<b>38</b>
<b>8. Block Diagram</b> .....	<b>40</b>
<b>9. Memory Size</b> .....	<b>41</b>
<b>10. Memory Map</b> .....	<b>41</b>
<b>11. Pin Status in Each CPU State</b> .....	<b>44</b>
<b>12. Electrical Characteristics</b> .....	<b>51</b>
12.1 Absolute Maximum Ratings.....	51
12.2 Recommended Operating Conditions.....	52
12.3 DC Characteristics.....	55
12.3.1 Current Rating.....	55
12.3.2 Pin Characteristics .....	62
12.4 AC Characteristics.....	64
12.4.1 Main Clock Input Characteristics.....	64
12.4.2 Sub Clock Input Characteristics .....	65
12.4.3 Built-in CR Oscillation Characteristics.....	65
12.4.4 Operating Conditions of Main PLL (In the Case of Using Main Clock for Input Clock of PLL).....	66
12.4.5 Operating Conditions of Main PLL (In the Case of Using Built-in High-speed CR Clock for Input Clock of Main PLL).....	66
12.4.6 Reset Input Characteristics .....	66
12.4.7 Power-on Reset Timing.....	67
12.4.8 GPIO Output Characteristics.....	67
12.4.9 Base Timer Input Timing .....	68
12.4.10 UART Timing.....	69
12.4.11 External Input Timing.....	94
12.4.12 Quadrature Position/Revolution Counter Timing .....	95
12.4.13 I <sup>2</sup> C Timing.....	97
12.4.14 JTAG Timing.....	99
12.5 12-bit A/D Converter.....	100
12.6 12-bit D/A Converter.....	103
12.7 Low-Voltage Detection Characteristics.....	104
12.7.1 Low-Voltage Detection Reset.....	104
12.7.2 Interrupt of Low-Voltage Detection.....	104
12.8 MainFlash Memory Write/Erase Characteristics.....	105
12.9 WorkFlash Memory Write/Erase Characteristics .....	105
12.10 Standby Recovery Time .....	106

12.10.1 Recovery cause: Interrupt/WKUP.....	106
12.10.2 Recovery Cause: Reset.....	108
<b>13. Ordering Information .....</b>	<b>110</b>
<b>14. Package Dimensions .....</b>	<b>111</b>
<b>15. Major Changes .....</b>	<b>116</b>
<b>Document History.....</b>	<b>117</b>
<b>Sales, Solutions, and Legal Information.....</b>	<b>118</b>

## 1. Product Lineup

### Memory Size

Product name	MB9BF164K/L	MB9BF165K/L	MB9BF166K/L
MainFlash memory	256 Kbytes	384 Kbytes	512 Kbytes
WorkFlash memory	32 Kbytes	32 Kbytes	32 Kbytes
On-chip SRAM	32 Kbytes	48 Kbytes	64 Kbytes
SRAM0	16 Kbytes	24 Kbytes	32 Kbytes
SRAM1	8 Kbytes	12 Kbytes	16 Kbytes
SRAM1	8 Kbytes	12 Kbytes	16 Kbytes

### Function

Product name	MB9BF164K MB9BF165K MB9BF166K	MB9BF164L MB9BF165L MB9BF166L
Pin count	48	64
CPU	Cortex-M4F, MPU, NVIC 128ch.	
Freq.	160 MHz	
Power supply voltage range	2.7 V to 5.5 V	
DMAC	8ch.	
DSTC	128ch.	
Multi-function Serial Interface (UART/CSIO/LIN/I <sup>2</sup> C)	6ch. (Max) (In ch.1, only I <sup>2</sup> C is available.)	6ch. (Max)
Base Timer (PWC/Reload timer/PWM/PPG)	8ch. (Max)	
MF Timer	A/D activation compare	6ch.
	Input capture	4ch.
	Free-run timer	3ch.
	Output compare	6ch.
	Waveform generator	3ch.
	PPG	3ch.
	1 unit	2 units (Max)
QPRC	1ch.	
Dual Timer	1 unit	
Real-Time Clock	1 unit	
Watch Counter	1 unit	
CRC Accelerator	Yes	
Watchdog Timer	1ch. (SW) + 1ch. (HW)	
External Interrupts	15 pins (Max) + NMI × 1	16 pins (Max) + NMI × 1
I/O Ports	33 pins (Max)	48 pins (Max)
12-bit A/D Converter	8ch. (2 units)	15ch. (2 units)
12-bit D/A Converter	2 units (Max)	
CSV (Clock Super Visor)	Yes	
LVD (Low-Voltage Detector)	2ch.	
Built-in CR	High-speed	4 MHz (±2%)
	Low-speed	100 kHz (Typ)
Debug Function	SWJ-DP	
Unique ID	Yes	

#### Note:

- All signals of the peripheral function in each product cannot be allocated by limiting the pins of package. It is necessary to use the port relocate function of the I/O port according to your function use.



## 2. Packages

Package	Product name	MB9BF164K MB9BF165K MB9BF166K	MB9BF164L MB9BF165L MB9BF166L
LQFP: FPT-64P-M39 (0.65mm pitch)		-	○
LQFP: FPT-64P-M38 (0.5mm pitch)		-	○
LQFP: FPT-48P-M49 (0.5mm pitch)		○	-
QFN: LCC-64P-M24 (0.5mm pitch)		-	○
QFN: LCC-48P-M73 (0.5mm pitch)		○	-

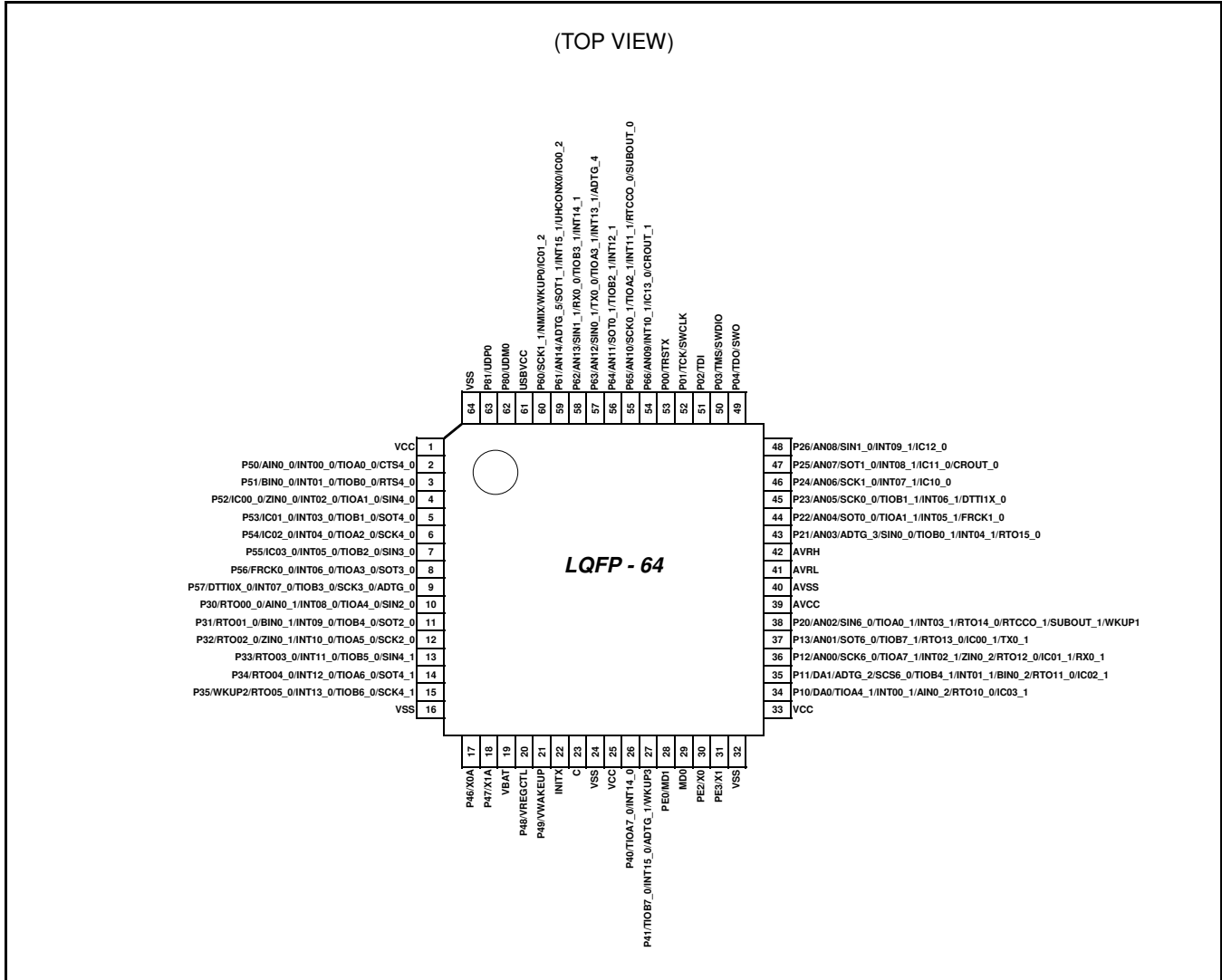
○: Supported

**Note:**

- See 14. Package Dimensions for detailed information on each package.

### 3. Pin Assignment

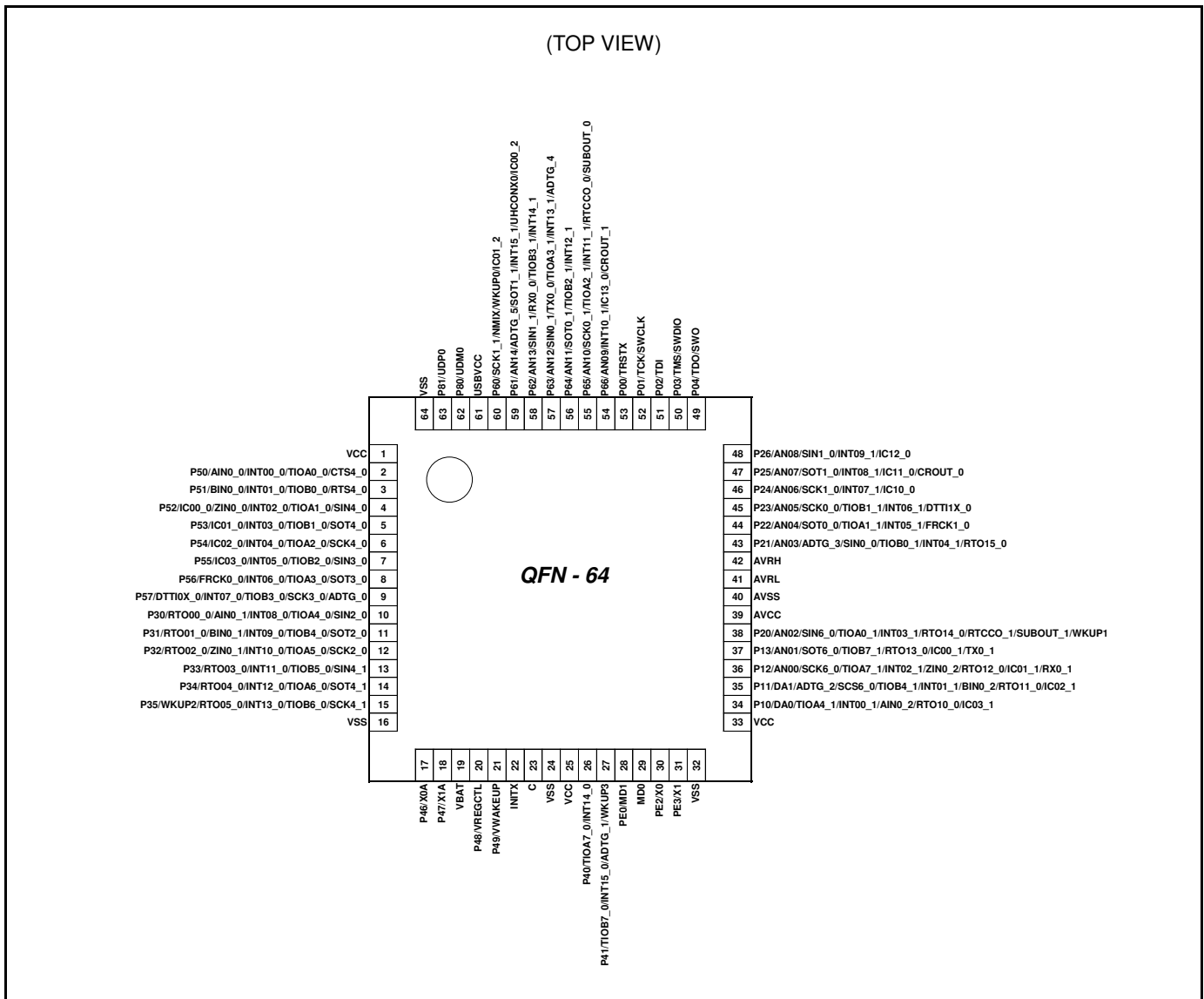
#### FPT-64P-M38/M39



**Note:**

- The number after the underscore ("\_") in pin names such as XXX\_1 and XXX\_2 indicates the relocated port number. For these pins, there are multiple pins that provide the same function for the same channel. Use the extended port function register (EPFR) to select the pin.

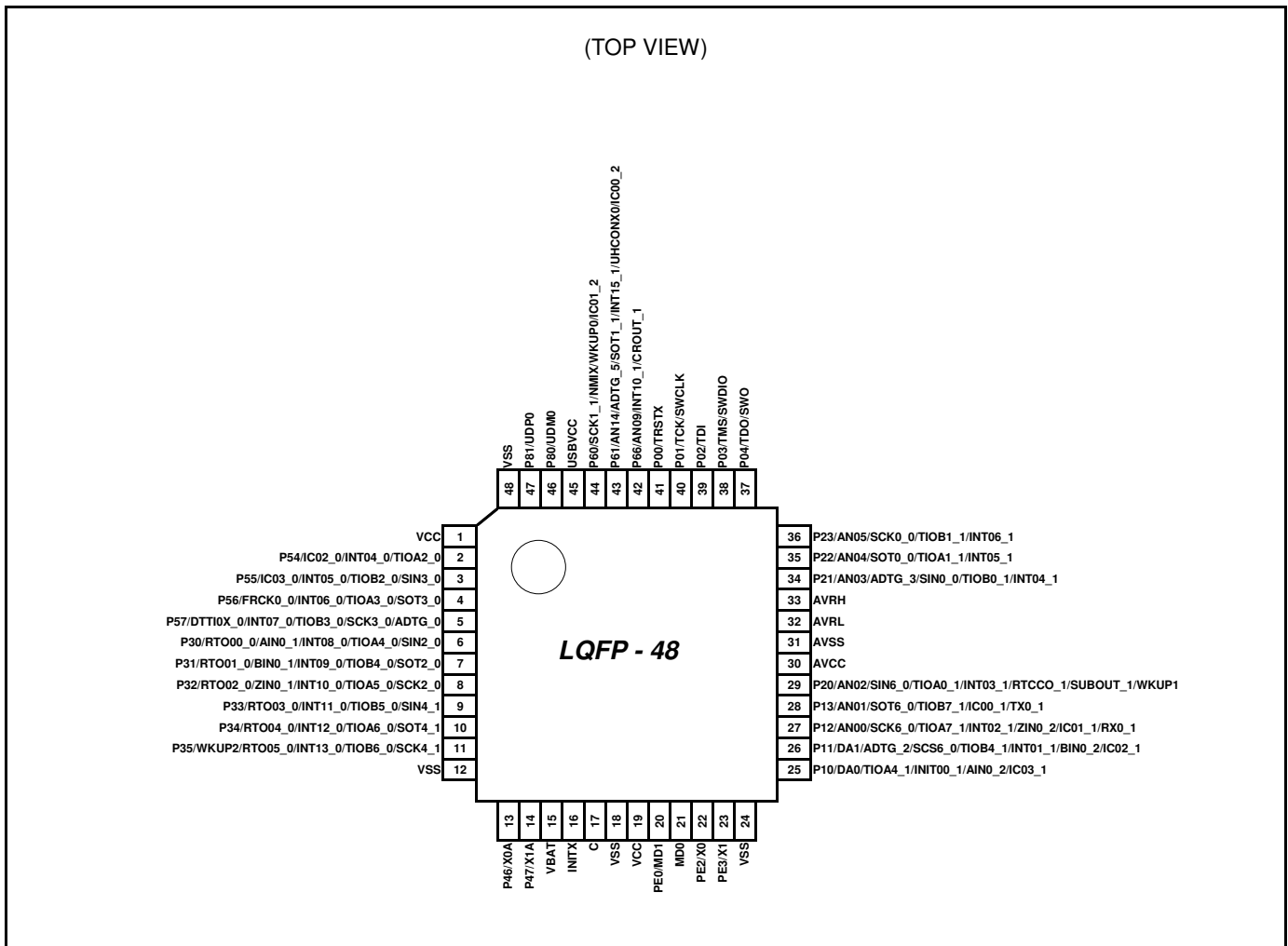
**LCC-64P-M24**



**Note:**

- The number after the underscore ("\_") in pin names such as XXX\_1 and XXX\_2 indicates the relocated port number. For these pins, there are multiple pins that provide the same function for the same channel. Use the extended port function register (EPFR) to select the pin.

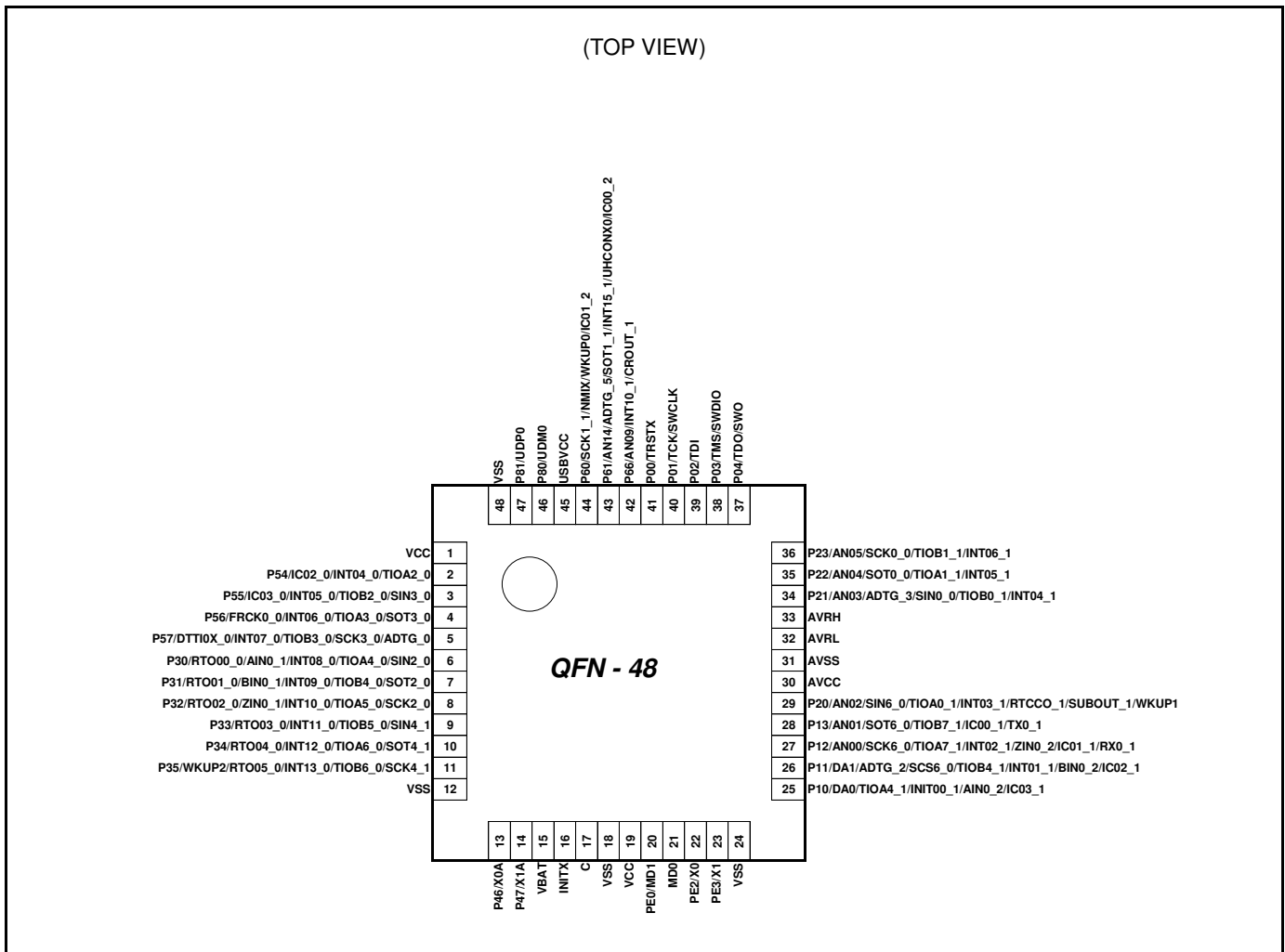
## FPT-48P-M49



**Note:**

- The number after the underscore ("\_") in pin names such as XXX\_1 and XXX\_2 indicates the relocated port number. For these pins, there are multiple pins that provide the same function for the same channel. Use the extended port function register (EPFR) to select the pin.

## LCC-48P-M73



**Note:**

- The number after the underscore ("\_") in pin names such as XXX\_1 and XXX\_2 indicates the relocated port number. For these pins, there are multiple pins that provide the same function for the same channel. Use the extended port function register (EPFR) to select the pin.



## 4. Pin Description

### 4.1 List of Pin Numbers

The number after the underscore ("\_") in pin names such as XXX\_1 and XXX\_2 indicates the relocated port number. For these pins, there are multiple pins that provide the same function for the same channel. Use the extended port function register (EPFR) to select the pin.

Pin No		Pin Name	I/O circuit type	Pin state type
LQFP64 QFN64	LQFP48 QFN48			
1	1	VCC	-	-
2	-	P50	E	K
		AIN0_0		
		INT00_0		
		TIOA0_0		
		CTS4_0		
3	-	P51	E	K
		BIN0_0		
		INT01_0		
		TIOB0_0		
		RTS4_0		
4	-	P52	I	K
		IC00_0		
		ZIN0_0		
		INT02_0		
		TIOA1_0		
		SIN4_0		
5	-	P53	N	K
		IC01_0		
		INT03_0		
		TIOB1_0		
		SOT4_0 (SDA4_0)		
6	2	P54	N	K
	-	IC02_0		
		INT04_0		
		TIOA2_0		
		SCK4_0 (SCL4_0)		
7	3	P55	I	K
		IC03_0		
		INT05_0		
		TIOB2_0		
		SIN3_0		
8	4	P56	N	K
		FRCK0_0		
		INT06_0		
		TIOA3_0		
		SOT3_0 (SDA3_0)		

Pin No		Pin Name	I/O circuit type	Pin state type
LQFP64 QFN64	LQFP48 QFN48			
9	5	P57	N	K
		DTT10X_0		
		INT07_0		
		TIOB3_0		
		SCK3_0 (SCL3_0)		
		ADTG_0		
10	6	P30	G	K
		RTO00_0		
		AIN0_1		
		INT08_0		
		TIOA4_0		
		SIN2_0		
11	7	P31	G	K
		RTO01_0		
		BIN0_1		
		INT09_0		
		TIOB4_0		
		SOT2_0 (SDA2_0)		
12	8	P32	G	K
		RTO02_0		
		ZIN0_1		
		INT10_0		
		TIOA5_0		
		SCK2_0 (SCL2_0)		
13	9	P33	G	K
		RTO03_0		
		INT11_0		
		TIOB5_0		
		SIN4_1		
14	10	P34	G	K
		RTO04_0		
		INT12_0		
		TIOA6_0		
		SOT4_1 (SDA4_1)		
15	11	P35	G	Q
		WKUP2		
		RTO05_0		
		INT13_0		
		TIOB6_0		
		SCK4_1 (SCL4_1)		

Pin No		Pin Name	I/O circuit type	Pin state type
LQFP64 QFN64	LQFP48 QFN48			
16	12	VSS	-	-
17	13	P46	P	S
		X0A		
18	14	P47	Q	T
		X1A		
19	15	VBAT		
20	-	P48	O	U
		VREGCTL		
21	-	P49	O	U
		VWAKEUP		
22	16	INITX	B	C
23	17	C	-	-
24	18	VSS	-	-
25	19	VCC	-	-
26	-	P40	E	K
		TIOA7_0		
		INT14_0		
27	-	P41	E	Q
		TIOB7_0		
		INT15_0		
		ADTG_1		
		WKUP3		
28	20	PE0	C	E
		MD1		
29	21	MD0	J	D
30	22	PE2	A	A
		X0		
31	23	PE3	A	B
		X1		
32	24	VSS	-	-
33	-	VCC	-	-
34	25	P10	R	J
		DA0		
		TIOA4_1		
		INT00_1		
		AIN0_2		
	IC03_1			
-	RTO10_0			
35	26	P11	R	J
		DA1		
		ADTG_2		
		SCS6_0		
		TIOB4_1		
		INT01_1		
		BIN0_2		
	IC02_1			
-	RTO11_0			

Pin No		Pin Name	I/O circuit type	Pin state type
LQFP64 QFN64	LQFP48 QFN48			
36	27	P12	M	M
		AN00		
		SCK6_0		
		TIOA7_1		
		INT02_1		
		ZIN0_2		
		IC01_1		
-	RTO12_0			
37	28	P13	M	L
		AN01		
		SOT6_0 (SDA6_0)		
		TIOB7_1		
		IC00_1		
-	RTO13_0			
38	29	P20	F	O
		AN02		
		SIN6_0		
		TIOA0_1		
		INT03_1		
		RTCCO_1		
		SUBOUT_1		
		WKUP1		
-	RTO14_0			
39	30	AVCC	-	-
40	31	AVSS	-	-
41	32	AVRL	-	-
42	33	AVRH	-	-
43	34	P21	F	M
		AN03		
		ADTG_3		
		SIN0_0		
		TIOB0_1		
		INT04_1		
-	RTO15_0			
44	35	P22	F	M
		AN04		
		SOT0_0 (SDA0_0)		
		TIOA1_1		
		INT05_1		
-	FRCK1_0			
45	36	P23	F	M
		AN05		
		SCK0_0 (SCL0_0)		
		TIOB1_1		
		INT06_1		
		-		

Pin No		Pin Name	I/O circuit type	Pin state type
LQFP64 QFN64	LQFP48 QFN48			
46	-	P24	F	M
		AN06		
		SCK1_0 (SCL1_0)		
		INT07_1		
		IC10_0		
47	-	P25	F	M
		AN07		
		SOT1_0 (SDA1_0)		
		INT08_1		
		IC11_0		
48	-	CROUT_0	F	M
		P26		
		AN08		
		SIN1_0		
		INT09_1		
49	37	IC12_0	E	G
		P04		
		TDO		
		SWO		
		P03		
50	38	TMS	E	G
		SWDIO		
		P02		
51	39	TDI	E	G
		P01		
52	40	TCK	E	G
		SWCLK		
		P00		
53	41	TRSTX	E	G
		P66		
54	42	AN09	F	M
		INT10_1		
		CROUT_1		
		IC13_0		
55	-	P65	L	M
		AN10		
		SCK0_1 (SCL0_1)		
		TIOA2_1		
		INT11_1		
		RTCCO_0		
		SUBOUT_0		
56	-	P64	L	M
		AN11		
		SOT0_1 (SDA0_1)		
		TIOB2_1		
		INT12_1		



Pin No		Pin Name	I/O circuit type	Pin state type
LQFP64 QFN64	LQFP48 QFN48			
57	-	P63	F	M
		AN12		
		SIN0_1		
		TIOA3_1		
		INT13_1		
		ADTG_4		
58	-	P62	F	M
		AN13		
		SIN1_1		
		TIOB3_1		
		INT14_1		
59	43	P61	F	M
		AN14		
		ADTG_5		
		SOT1_1 (SDA1_1)		
		INT15_1		
		IC00_2		
60	44	P60	I	F
		SCK1_1 (SCK1_1)		
		NMIX		
		WKUP0		
		IC01_2		
61	45	VCC	-	-
62	46	P80	H	R
63	47	P81	H	R
64	48	VSS	-	-

## 4.2 List of Pin Functions

The number after the underscore ("\_") in pin names such as XXX\_1 and XXX\_2 indicates the relocated port number. For these pins, there are multiple pins that provide the same function for the same channel. Use the extended port function register (EPFR) to select the pin.

Pin function	Pin name	Function description	Pin No	
			LQFP64 QFN64	LQFP48 QFN48
ADC	ADTG_0	A/D converter external trigger input pin	9	5
	ADTG_1		27	-
	ADTG_2		35	26
	ADTG_3		43	34
	ADTG_4		57	-
	ADTG_5		59	43
	AN00	A/D converter analog input pin. ANxx describes ADC ch.xx.	36	27
	AN01		37	28
	AN02		38	29
	AN03		43	34
	AN04		44	35
	AN05		45	36
	AN06		46	-
	AN07		47	-
	AN08		48	-
	AN09		54	42
	AN10		55	-
	AN11		56	-
	AN12		57	-
	AN13		58	-
AN14	59		43	
Base Timer 0	TIOA0_0	Base timer ch.0 TIOA pin	2	-
	TIOA0_1		38	29
	TIOB0_0	Base timer ch.0 TIOB pin	3	-
	TIOB0_1		43	34
Base Timer 1	TIOA1_0	Base timer ch.1 TIOA pin	4	-
	TIOA1_1		44	35
	TIOB1_0	Base timer ch.1 TIOB pin	5	-
	TIOB1_1		45	36
Base Timer 2	TIOA2_0	Base timer ch.2 TIOA pin	6	2
	TIOA2_1		55	-
	TIOB2_0	Base timer ch.2 TIOB pin	7	3
	TIOB2_1		56	-
Base Timer 3	TIOA3_0	Base timer ch.3 TIOA pin	8	4
	TIOA3_1		57	-
	TIOB3_0	Base timer ch.3 TIOB pin	9	5
	TIOB3_1		58	-
Base Timer 4	TIOA4_0	Base timer ch.4 TIOA pin	10	6
	TIOA4_1		34	25
	TIOB4_0	Base timer ch.4 TIOB pin	11	7
	TIOB4_1		35	26
Base Timer 5	TIOA5_0	Base timer ch.5 TIOA pin	12	8
	TIOB5_0	Base timer ch.5 TIOB pin	13	9

Pin function	Pin name	Function description	Pin No	
			LQFP64 QFN64	LQFP48 QFN48
Base Timer 6	TIOA6_0	Base timer ch.6 TIOA pin	14	10
	TIOB6_0	Base timer ch.6 TIOB pin	15	11
Base Timer 7	TIOA7_0	Base timer ch.7 TIOA pin	26	-
	TIOA7_1		36	27
	TIOB7_0	Base timer ch.7 TIOB pin	27	-
	TIOB7_1		37	28
Debugger	SWCLK	Serial wire debug interface clock input pin	52	40
	SWDIO	Serial wire debug interface data input / output pin	50	38
	SWO	Serial wire viewer output pin	49	37
	TCK	JTAG test clock input pin	52	40
	TDI	JTAG test data input pin	51	39
	TDO	JTAG debug data output pin	49	37
	TMS	JTAG test mode state input/output pin	50	38
	TRSTX	JTAG test reset Input pin	53	41
External Interrupt	INT00_0	External interrupt request 00 input pin	2	-
	INT00_1		34	25
	INT01_0	External interrupt request 01 input pin	3	-
	INT01_1		35	26
	INT02_0	External interrupt request 02 input pin	4	-
	INT02_1		36	27
	INT03_0	External interrupt request 03 input pin	5	-
	INT03_1		38	29
	INT04_0	External interrupt request 04 input pin	6	2
	INT04_1		43	34
INT05_0	External interrupt request 05 input pin	7	3	
INT05_1		44	35	

Pin function	Pin name	Function description	Pin No	
			LQFP64 QFN64	LQFP48 QFN48
External Interrupt	INT06_0	External interrupt request 06 input pin	8	4
	INT06_1		45	36
	INT07_0	External interrupt request 07 input pin	9	5
	INT07_1		46	-
	INT08_0	External interrupt request 08 input pin	10	6
	INT08_1		47	-
	INT09_0	External interrupt request 09 input pin	11	7
	INT09_1		48	-
	INT10_0	External interrupt request 10 input pin	12	8
	INT10_1		54	42
	INT11_0	External interrupt request 11 input pin	13	9
	INT11_1		55	-
	INT12_0	External interrupt request 12 input pin	14	10
	INT12_1		56	-
	INT13_0	External interrupt request 13 input pin	15	11
	INT13_1		57	-
	INT14_0	External interrupt request 14 input pin	26	-
INT14_1	58		-	
INT15_0	External interrupt request 15 input pin	27	-	
INT15_1		59	43	
	NMIX	Non-Maskable Interrupt input pin	60	44
GPIO	P00	General-purpose I/O port 0	53	41
	P01		52	40
	P02		51	39
	P03		50	38
	P04		49	37
	P10	General-purpose I/O port 1	34	25
	P11		35	26
	P12		36	27
	P13		37	28
	P20	General-purpose I/O port 2	38	29
	P21		43	34
	P22		44	35
	P23		45	36
	P24		46	-
	P25		47	-
	P26	48	-	
	P30	General-purpose I/O port 3	10	6
	P31		11	7
	P32		12	8
	P33		13	9
P34	14		10	
P35	15		11	

Pin function	Pin name	Function description	Pin No	
			LQFP64 QFN64	LQFP48 QFN48
GPIO	P40	General-purpose I/O port 4	26	-
	P41		27	-
	P46		17	13
	P47		18	14
	P48		20	-
	P49		21	-
	P50	General-purpose I/O port 5	2	-
	P51		3	-
	P52		4	-
	P53		5	-
	P54		6	2
	P55		7	3
	P56		8	4
	P57	9	5	
	P60	General-purpose I/O port 6	60	44
	P61		59	43
	P62		58	-
	P63		57	-
	P64		56	-
	P65		55	-
	P66		54	42
	P80	General-purpose I/O port 8	62	46
	P81		63	47
PE0	General-purpose I/O port E	28	20	
PE2		30	22	
PE3		31	23	



Pin function	Pin name	Function description	Pin No	
			LQFP64 QFN64	LQFP48 QFN48
Multi-function Serial 0	SIN0_0	Multi-function serial interface ch.0 input pin	43	34
	SIN0_1		57	-
	SOT0_0 (SDA0_0)	Multi-function serial interface ch.0 output pin. This pin operates as SOT0 when it is used in a UART/CSIO/LIN (operation modes 0 to 3) and as SDA0 when it is used in an I <sup>2</sup> C (operation mode 4).	44	35
	SOT0_1 (SDA0_1)		56	-
	SCK0_0 (SCL0_0)	Multi-function serial interface ch.0 clock I/O pin. This pin operates as SCK0 when it is used in a CSIO (operation modes 2) and as SCL0 when it is used in an I <sup>2</sup> C (operation mode 4).	45	36
	SCK0_1 (SCL0_1)		55	-
Multi-function Serial 1	SIN1_0	Multi-function serial interface ch.1 input pin	48	-
	SIN1_1		58	-
	SOT1_0 (SDA1_0)	Multi-function serial interface ch.1 output pin. This pin operates as SOT1 when it is used in a UART/CSIO/LIN (operation modes 0 to 3) and as SDA1 when it is used in an I <sup>2</sup> C (operation mode 4).	47	-
	SOT1_1 (SDA1_1)		59	43
	SCK1_0 (SCL1_0)	Multi-function serial interface ch.1 clock I/O pin. This pin operates as SCK1 when it is used in a CSIO (operation modes 2) and as SCL1 when it is used in an I <sup>2</sup> C (operation mode 4).	46	-
	SCK1_1 (SCL1_1)		60	44
Multi-function Serial 2	SIN2_0	Multi-function serial interface ch.2 input pin	10	6
	SOT2_0 (SDA2_0)	Multi-function serial interface ch.2 output pin. This pin operates as SOT2 when it is used in a UART/CSIO/LIN (operation modes 0 to 3) and as SDA2 when it is used in an I <sup>2</sup> C (operation mode 4).	11	7
	SCK2_0 (SCL2_0)	Multi-function serial interface ch.2 clock I/O pin. This pin operates as SCK2 when it is used in a CSIO (operation modes 2) and as SCL2 when it is used in an I <sup>2</sup> C (operation mode 4).	12	8

Pin function	Pin name	Function description	Pin No	
			LQFP64 QFN64	LQFP48 QFN48
Multi-function Serial 3	SIN3_0	Multi-function serial interface ch.3 input pin	7	3
	SOT3_0 (SDA3_0)	Multi-function serial interface ch.3 output pin. This pin operates as SOT3 when it is used in a UART/CSIO/LIN (operation modes 0 to 3) and as SDA3 when it is used in an I <sup>2</sup> C (operation mode 4).	8	4
	SCK3_0 (SCL3_0)	Multi-function serial interface ch.3 clock I/O pin. This pin operates as SCK3 when it is used in a CSIO (operation modes 2) and as SCL3 when it is used in an I <sup>2</sup> C (operation mode 4).	9	5
Multi-function Serial 4	SIN4_0	Multi-function serial interface ch.4 input pin	4	-
	SIN4_1		13	9
	SOT4_0 (SDA4_0)	Multi-function serial interface ch.4 output pin. This pin operates as SOT4 when it is used in a UART/CSIO/LIN (operation modes 0 to 3) and as SDA4 when it is used in an I <sup>2</sup> C (operation mode 4).	5	-
	SOT4_1 (SDA4_1)		14	10
	SCK4_0 (SCL4_0)	Multi-function serial interface ch.4 clock I/O pin. This pin operates as SCK4 when it is used in a CSIO (operation modes 2) and as SCL4 when it is used in an I <sup>2</sup> C (operation mode 4).	6	-
	SCK4_1 (SCL4_1)		15	11
	CTS4_0	Multi-function serial interface ch.4 CTS input pin	2	-
RTS4_0	Multi-function serial interface ch.4 RTS output pin	3	-	
Multi-function Serial 6	SIN6_0	Multi-function serial interface ch.6 input pin	38	29
	SOT6_0 (SDA6_0)	This pin operates as SOT6 when it is used in a UART/CSIO/LIN (operation modes 0 to 3) and as SDA6 when it is used in an I <sup>2</sup> C (operation mode 4).	37	28
	SCK6_0 (SCL6_0)	Multi-function serial interface ch.6 clock I/O pin. This pin operates as SCK6 when it is used in a CSIO (operation modes 2) and as SCL6 when it is used in an I <sup>2</sup> C (operation mode 4).	36	27
	SCS6_0	Multi-function serial interface ch.6 serial chip select pin	35	26

Pin function	Pin name	Function description	Pin No	
			LQFP64 QFN64	LQFP48 QFN48
Multi- function Timer 0	DTTI0X_0	Input signal controlling wave form generator outputs RTO00 to RTO05 of Multi-function timer 0.	9	5
	FRCK0_0	16-bit free-run timer ch.0 external clock input pin	8	4
	IC00_0	16-bit input capture ch.0 input pin of Multi-function timer 0. ICxx describes channel number.	4	-
	IC00_1		37	28
	IC00_2		59	43
	IC01_0		5	-
	IC01_1		36	27
	IC01_2		60	44
	IC02_0		6	2
	IC02_1		35	26
	IC03_0		7	3
	IC03_1		34	25
	RTO00_0 (PPG00_0)	Wave form generator output pin of Multi-function timer 0. This pin operates as PPG00 when it is used in PPG0 output modes.	10	6
	RTO01_0 (PPG00_0)	Wave form generator output pin of Multi-function timer 0. This pin operates as PPG00 when it is used in PPG0 output modes.	11	7
	RTO02_0 (PPG02_0)	Wave form generator output pin of Multi-function timer 0. This pin operates as PPG02 when it is used in PPG0 output modes.	12	8
	RTO03_0 (PPG02_0)	Wave form generator output pin of Multi-function timer 0. This pin operates as PPG02 when it is used in PPG0 output modes.	13	9
	RTO04_0 (PPG04_0)	Wave form generator output pin of Multi-function timer 0. This pin operates as PPG04 when it is used in PPG0 output modes.	14	10
RTO05_0 (PPG04_0)	Wave form generator output pin of Multi-function timer 0. This pin operates as PPG04 when it is used in PPG0 output modes.	15	11	